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(54) Vehicle toy mounting projectile launching mechanism

(57) The toy 10 shows much originality in operation without using a complex circuit, is improved in flight range by using a simple and low-cost mechanism, permits a user to play with it safely, and comprises: a structure 15 mounted on the toy 10 and capable of moving from a first position to a second position so as to form in outline a part of a body 12 of the toy 10 in the first position and pop out of the body 12 in the second position; a popping-out mechanism by which the structure 15 is moved from the first position to the second position so as to pop out of the body 12; a launching platform 48 having the launching mechanism which is provided in the structure 15 so as to be housed in the body 12 in the first position and appear in sight in its launching position when the structure 15 is in the second position; and, a launching control means for controlling the launching mechanism.

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Description

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a vehicle toy mounting a projectile-launching mechanism, which has extraordinary powers, i.e., which can be remotely controlled so as to pop a projectile-launching platform out of a vehicle body and launch a projectile therefrom, the projectile-launching platform being housed in the vehicle body in a time other than the projectile-launching time described above.

Description of the Prior Art:

A conventional ground vehicle toy mounting a projectile-launching mechanism has its projectile-launching portion exposed to the enemy, and, therefore is easily recognized as a projectile-launching vehicle before the projectile is launched from such projectile-launching portion of the vehicle toy. Further, the conventional vehicle toy lacks in originality and is poor in the number of the projectiles stored in the vehicle toy. Consequently, the projectiles are immediately exhausted when continuously launched, which sometimes makes it impossible to hit a target. On the other hand, in order to increase the range of the projectile, it is necessary to increase the muzzle velocity of the projectile, which requires to take necessary safety precautions, for example, by the use of a cushion member attached to a front end of the projectile so as to decrease an impact force of the projectile when the projectile hits against a person. However, such cushion member causes the projectile to tumble in flight, which often makes it impossible to have the cushion member of the projectile positioned forward in flight attitude. Therefore, in the conventional vehicle toy, in order to decrease the impact force of the projectile thereof, it is necessary to decrease the muzzle velocity of the projectile.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a vehicle toy having a projectile-launching function, which has originality in action and increases the range of a projectile by the use of a simple and the least expensive mechanism without using a complex electronic circuit, the vehicle toy being excellent in safety and also in play value in operation.

The above object of the present invention is accomplished by providing:

A remotely-controlled vehicle toy mounting a projectile-launching mechanism comprising:

a structure which is mounted on a vehicle body of the vehicle toy and capable of moving from a first position to a second position so as to form in outline a part of the vehicle body in the first position and pop out of the vehicle body in the second position;

a popping-out mechanism through which the structure is moved from the first position to the second position so as to pop out of the vehicle body;

a projectile-launching platform provided with a projectile-launching mechanism which is provided in the structure so as to be housed in the vehicle body in the first position and appear in sight in its projectile-launching position when the structure is in the second position; and

a projectile-launching control means for controlling the projectile-launching mechanism.

In the vehicle toy of the present invention, it is preferable that: the structure has one of its opposite end portions pivotally attached to a portion of the vehicle body and the other of the opposite end portions formed into a free-end portion on which the projectile-launching platform provided with the projectile-launching mechanism is mounted; the projectile-launching platform is provided with at least one projectile-launching sleeve; the projectile-launching mechanism is provided with a projectile-energizing means for giving a flight force to a projectile, a restricting means for temporarily restricting the launching of the projectile, and a release means for releasing the projectile from restrictions placed upon the launching of the projectile; the projectile-launching control means is provided with a release mechanism which drives the release means so as to release the projectile from the restrictions upon receipt of a radio signal; the projectile-launching platform is provided with a guide portion in its projectile-loading portion, the guide portion being provided with at least two slits; the projectile is constructed of a head and a tail cylindrical portion, the tail cylindrical portion being provided with an engaging groove while the head cylindrical portion is covered with a cushion member, the tail cylindrical portion being further provided with at least two helical projections in its outer peripheral portion, the helical projections being small in helix angle and loosely and threadably connected with the slits of the guide portion of the projectile-launching platform; said popping-out mechanism is provided with a structure-energizing means for giving a popping-out force to the structure so as to move the structure from the first position to the second position, a slidably movable hook on which a resilient force is applied to urge the movable hook toward its engaging direction so as to have said movable hook engage in the first position with a stationary hook provided in a portion of the vehicle body and disengage from the stationary hook in the second position, and a rib gear driven by a motor and provided with a knock rib which is rotatably driven to kick a hook base of the movable hook so as to slidably move the movable hook from its engaging position to its disengaging position; the projectile-launching mechanism is provided with a launching spring for launching the projectile, the projectile-launching platform with at least one through-hole for holding the projectile

thereto, a cam ring with a rotatably-driven protruding cam, and a projectile stopper which is provided with a stopper boss abutting on the protruding cam and an engaging-end portion inserted into the engaging groove of the projectile so as to prevent the projectile from launching, the projectile stopper being driven by the protruding cam, whereby the protruding cam of the cam ring intermittently rotated abuts on the stopper boss so as to slidably move the projectile stopper in its disengaging direction.

In the vehicle toy mounting the projectile-launching mechanism of the present invention having the above construction: the structure mounted on the vehicle toy forms in outline a part of the vehicle body in the first position thereof, and pops out of the vehicle body through the actuation of the popping-out mechanism to permit the projectile-launching platform with the projectile-launching mechanism to come in slight; and, the projectile-launching mechanism is controlled by the projectile-launching control means so the the projectile is launched. Therefore, the vehicle toy of the present invention shows much originality in operation without using complex electronic circuits, is improved in flight range by using a simple and low-cost mechanism, and permits a user to play with it safely.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perepective view of the vehicle toy of an embodiment of the present invention in a condition in which the structure is in its second pop-up or expanded position;

Fig. 2 is a a perspective view of the vehicle toy of the embodiment of the present invention in a condition in which the structure is in its first recessed position;

Fig. 3 is a sectional side view of the vehicle toy shown in Fig. 2;

Fig. 4 is a a sectional side view of the vehicle toy shown in Fig. 1;

Fig. 5 is a partially broken plan view of the vehicle toy shown in Fig. 2;

Fig. 6 is a front view of the vehicle toy shown in Fig. 1;

Fig. 7 is an exploded perspective view of the projectile-launching mechanism of the embodiment of the present invention, illustrating its components;

Fig. 8 is a longitudinal sectional view of the projectile-launching portion of the embodiment of the present invention;

Fig. 9 is a perspective view of the projectile of the embodiment of the present invention;

Figs. 10 to 17 are views illustrating steps in the lifting operations of the structure and in the launching operations of the projectile;

Fig. 18 is a perspective view of a portable remote-control unit of the embodiment of the present invention;

Fig. 19 is a block diagram of the remote-control unit of the embodiment of the present invention; and

Fig. 20 is a block diagram of a control circuit of the vehicle toy of the embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinbelow, the present invention will be described in detail with reference to the accompanying drawings.

A vehicle toy 10 mounting a projectile-launching mechanism of an embodiment of the present invention is remote-controlled by wire or by wireless through a remote-control unit 120 which issues a control signal to the vehicle toy 10. The vehicle toy 10 is provided with a chassis 11 and a vehicle body 12 mounted on the chassis 11. Further, the vehicle toy 10 is provided with left and right front steerable wheels 13a, 13b together with left and right rear drive wheel 14a, 14b. Steering operation of the vehicle toy 10 is conducted by using a link arm through which the front wheels 13a, 13b are pivoted to a front-end portion of the vehicle toy 10. In steering operations, the front wheels 13a, 13b are moved together right and left in a desired manner through an electrically-energized actuator 18 provided in a steering portion of the vehicle toy 10. Such steering operation conducted through the actuator 18 is well known, for example, as shown in U.S. Patent No. 5,261,853. The vehicle toy 10 is provided with a vehicle drive unit 25 which drives at least one of the rear drive wheels 14a, 14b through a reduction-gear unit 21 constructed of an appropriate gear train. Preferably, the rear wheels 14a, 14b are fixedly mounted on opposite ends of a rear axle 22 of the vehicle toy 10. A battery 24 serving as an electric power source of both the vehicle toy 10 and a radio receiver 26 for controlling the vehicle toy 10 are preferably mounted on a central portion of the chassis 11.

On the other hand, the vehicle body 12 is formed, for example, into a shape of an automobile such as a conventional truck in its front portion and into a shape of an open-top load-carrying box in its rear portion. A structure 15, which is an essential part of the vehicle toy 10 of the present invention, is swingably mounted in the load-carrying box of the vehicle body 12. More specifically, the structure 15 has its rear-end portion pivoted to the rear portion of the vehicle body 12 to permit its

front-end portion to swingably move upward under the influence of a compression coil spring 42. Such swingable upward movement of the front-end portion of the structure 15 tilts the structure 15 back. Consequently, the structure 15 may assume a first position in which the structure 15 is housed in the load-carrying box as shown in Fig. 2, or a second position in which the structure 15 is tilted back as shown in Fig. 1, and, therefore may swingably move between the first and the second position. The structure 15 has rear opposite ends of its lower-case portion 55 pivoted to the vehicle body 12. Further, the structure 15 is provided with a rear-body portion 23 which covers the load-carrying box of the vehicle body 12 and follows the front portion of the vehicle body 12 in contour. In other words, when the structure 15 is in the first position as shown in Fig. 2, the vehicle toy 10 entirely assumes the same shape as that of a conventional land vehicle or automobile in outline. On the other hand, when the structure 15 is in the second position as shown in Fig. 1, the front-end portion of the structure 15 moves upward to project from an upper portion of the vehicle toy 10, and, therefore comes in sight. As a result, the structure 15 assumes its tilting position to show a projectile launcher of the vehicle toy 10.

The structure 15 is provided with a projectile-launching platform 48 inside the rear-body portion 23. Further, the structure 15 is provided with a popping-out or expanding mechanism and a projectile-launching mechanism. The popping-out mechanism moves the structure 15 from the first position to the second position. On the other hand, the projectile-launching platform 48 is completely housed in the vehicle body 10 when the structure 15 is in the first position as shown in Fig. 2, and comes in sight when the structure 15 is in the second position as shown in Fig. 1.

Now, the structure 15 will be described in its mechanism. The structure 15 is provided with: the projectile-launching platform 48 for loading a projectile 50 and for housing therein a spring 44 producing a projectile-launching force and an upper case 54 and a lower case 55 in which gears and a motor of the projectile-launching mechanism and the popping-out mechanism are housed. As shown in Fig. 7, the lower case 55 of the structure 15 is provided with a pair of laterally-extending bearing portions 55a in its rear portion and a pair of bosses 55b which are provided in outer ends of the bearing portions 55a and formed into rod-like shapes extending vertically. The bearing portions 55a of the lower case 55 loosely engage with or are inserted into a pair of vertically-extending slits 12a which are formed in the load-carrying box of the rear portion of the vehicle body 12 so as to correspond in position to such bearing portions 55a of the lower case 55 of the structure 15. On the other hand, the bosses 55b of the lower case 55 in the structure 15 are loosely inserted into a pair of elongated holes 12b formed in a pair of oblique surfaces which are provided in the vehicle body 12 so as to be adjacent to the slits 12a of the vehicle body 12. Then, as shown in Fig. 7, the bosses 55b of the structure 15 have their lower-end portions engaged threadably with a pair of truss-head screws 29 so that the bosses 55b are prevented from being pulled out of the elongated holes 12b of the vehicle body 12. Since the structure 15 has the bearing portions 55a of its lower case 15 inserted rotatably in the slits 12a of the vehicle body 12 and also has the bosses 55b of its lower case 55 inserted slidably in the elongated holes 12b of the vehicle body 12, it is possible for the structure 15 to swing or tilt in the vehicle body 12. Further provided between a lower central portion of the lower case 55 of the structure 15 and the load-carrying box of the vehicle body 12 is a suitable resilient means, for example such as a compression coil spring 42, which resiliently urges the lower case 55 upward. In the load-carrying box of the vehicle body 12, there are provided a pair of stationary hooks 19 which are laterally spaced apart from each other by a predetermined distance, as is clear from Fig. 10. As shown in Fig. 4, each of the stationary hooks 19 is provided with a stationary-pawl portion 19a and an oblique-surface portion 19b which is inclined upward toward the front end of the vehicle body 12. In a condition in which the structure 15 is in the first position thereof, the stationary-pawl portion 19a of the stationary hook 19 engages with a movable-pawl portion 38b of a movable hook 38 provided in the structure 15 to hold the structure 15 in the load-carrying box of the vehicle body 12 against a resilient force exerted by the compression coil spring 42. When the movable hook 38 is disengaged from the stationary hook 19, the structure 15 swingably moves upward under the influence of the resilient force exerted by the compression coil spring 42 and reaches the second position on the vehicle body 12, as shown in Fig. 4.

The upper case 54 and the lower case 55 of the structure 15 are formed into one piece and disposed under the rear-body portion 23. Housed in the upper case 54 and the lower case 55 of the structure are: a motor 28; a pinion 30 provided on the motor 28; a first intermediate gear 32 driven by the pinion 30; a second intermediate gear 33 which is integrally formed with the first intermediate gear 32; a rib gear 34 and a cam ring 36 driven by the second intermediate gear 33; shafts 35 for supporting the gears and the cam; and, the movable hook 38.

As shown in Fig. 7 and Figs. 10 to 17, in the upper case 54 and the lower case 55 the first intermediate gear 32 meshes with the pinion 30 of the motor 28 and the second intermediate gear 33 meshes with the rib gear 34. The second intermediate gear 33 is large in face width to permit the rib gear 34 to slide widthwise (i.e., move back and forth as viewed in the traveling direction of the vehicle toy 10) relative to the second intermediate gear 33 on its shaft 35. As shown in Fig. 7, provided in a front surface of the rib gear 34 is a pin 34c extending forward. Provided in a rear surface of the rib gear 34 are: a first rib 34a extending from a center of the rib gear 34 radially outward; and, a second rib 34b extending from

an outer peripheral portion of the rib gear 34 radially inwardly. On the other hand, the cam ring 36 is mounted on the shaft 35 on which both the first intermediate gear 32 and the second intermediate gear 33 are also mounted. The cam ring 36 is rotatable relative to these intermediate gears 32, 33, and provided with an edge ring 36c in an outer peripheral portion of its front surface. As shown in Fig. 7, a pair of triangular inner cams 36b are formed in an inner surface of the edge ring 36c so as to radially inwardly extend and be oppositely disposed from each other in a diametrical direction of the cam ring 36. A cam rib 36a is in the rear surface of the rib gear 36, the cam rib 36a being provided with a plurality of radially-extending projections the number of which is, for example, ten. The rib gear 34 has its pin 34c engaged with the cam rib 36a of the cam ring 36 which in turn has its inner cam 36b engaged with bosses 401a, 402a, 403a, 404a and 405a (hereinafter simply the bosses 401a - 405a) of a projectile stopper 40. Each time the rib gear 34 turns 360 degrees, the pin 34c can engage one projection of cam rib 36a to turn cam ring about 36 degrees so that the inner cam 36b of the cam ring 36 depresses the bosses 401a - 405a one by one.

As shown in Fig. 7, the movable hook 38 assumes a substantially laterally-extending rod-like shape and is movably housed in the lower case 55 of the structure 15 so as to be slidable widthwise and back and forth. The movable hook 38 has its opposite-end portions exposed to the corresponding stationary hooks 19 in opposite sides of the lower case 55 of the structure 15. Formed in the opposite-end portions of the movable hook 38 are the movable-pawl portions 38b engaging with the stationary-pawl portions 19a of the stationary hooks 19 and the oblique surfaces 38c which abut on the stationary-pawl portions 19a of the stationary hooks 19 and slidably guide them when the movable-pawl portions 38b of the movable hooks 38 engage with the stationary-pawl portions 19a of the stationary hooks 19. Formed in an upper side of a substantially central portion of the movable hook 38 is a hook boss 38a which engages with the first rib 34a and the second rib 34b. A laterally-extending elongated groove 38d is formed slightly under the hook boss 38a in the movable hook 38, and movably receives a lower portion of the rib gear 34 therein so as to permit the rib gear 34 to laterally move by a predetermined distance. Further formed in a right portion of the movable hook 38 is a resilient hook 38e extending downward beyond the bottom of the lower case 55. A coil spring 46 has one of its opposite ends engage with the resilient hook 38e of the movable hook 38 and the other of its opposite ends engage with a resilient hook 55c formed in a left portion of the bottom of the lower case 55, so that the movable hook 38 is resiliently urged to the left and forward, as viewed in Fig. 10. Namely, the movable hook 38 is slidable widthwise in a condition in which the rib gear 34 is received in the elongated groove 38d of the movable hook 38, while slidable back and forth together with the rib gear 32.

The projectile-launching platform 48 is integrally provided with a front-plate portion 48b having five openings 48a, five relatively large-diameter projectile-launching sleeve portions 48c which have their front ends fixedly mounted on rear ends of the corresponding openings 48a of the front-plate portion 48b, five spring-housing portions 48d for housing five relatively small-diameter launching springs 44 therein, the spring-housing portions 48d being coaxially arranged with the corresponding sleeve portions 48c and fixedly mounted on the rear portions thereof. As is clear from Fig. 7, the five projectile-launching sleeve portions 48c of the projectile-launching platform 48 are equally spaced apart from each other on the periphery of an upper half of the the cam ring 36, and disposed in front of the lower case 55, as shown in Fig. 9. Formed inside each of the spring-housing portions 48d is a guide portion 48e provided with three rifles. Formed immediately before each of the guide portions 48e of the spring-housing portions 48d or immediately behind each of the projectile-launching sleeve portions 48c is a through-hole 48f for receiving therein a front-end portion of each of five stopper blades 401, 402, 403, 404 and 405 (hereinafter simply referred to as the stopper blades 401 - 405) of the projectile stopper 40. As is clear from Fig. 7, the stopper blades 401 - 405 radially outwardly extend from a center line of the cam ring 36.

The projectile stopper 40 is made of, for example, a molded elastomer. As shown in Fig. 7, the projectile stopper 40 is provided with a plurality of axial slits in the peripheral portion of its substantially semi-cylindrical portion a rear end of which is formed into five bent portions forming the stopper blades 401 - 405. As seen in Fig. 8, the semi-cylindrical portion of the projectile stopper 40 has its front-end portion fixedly mounted on the rear surface of the front-plate portion 48b of the projectile-launching platform 48. A front end of each of such five stopper blades 401 - 405 is inserted into the through-hole 48f or each of the five spring-housing portions 48d of the projectile-launching platform 48 and slightly extends radially inwardly into each of the spring-housing portions 48d so as to engage with an engaging groove 50d of the projectile 50. The stopper bosses 401a - 405a are formed in the rear surfaces of the bent portions of the stopper blades 401 - 405 so as to extend rearward toward the cam ring 36. Each of the stopper blades 401 - 405 is bent inwardly when each of their stopper bosses 401a - 405a, which is disposed inside the edge ring 36c of the cam ring 36, abuts on the inner cam 36c of the cam ring 36 in operation and is depressed radially inwardly in the cam ring 36. When each of the stopper bosses 401a - 405a is released from the inner cam 36c of the cam ring 36, each of the bosses 401a - 405a returns to its initial position due to resiliency of the projectile stopper 40.

The projectile 50 is preferably formed into a missile-like shape provided with a round-head portion 50a and a tail portion 50b which is integrally formed with a

rear end of the round-head portion 50a. Formed in outer peripheral portion of the tail portion 50b of the projectile 50 are three helical projections 50c which loosely and threadably engage with the guide portion 48a of the projectile-launching platform 48. In the projectile, 50, as shown in Fig. 9, each of the helical projections 50c is notched in the vicinity of the rear end of the round-head portion 50a to form the engaging groove 50d for receiving therein the front-end portion of each of the stopper blades 401 - 405 of the projectile stopper 40. The round-head portion 50a is preferably covered with a suitable cushion member made of foamed plastics, rubbers or sponges, and, therefore does not injure users even when the projectile 50 hits the users.

Fig. 18 is a perespective view showing a portable remote-control unit 120 for controlling the vehicle toy 10. The unit 120 is preferably constructed of an on/off switch 122, a first toggle-control lever 124 for controlling the vehicle toy 10 in back-and-forth motion, a second toggle-control lever 126 for controlling the vehicle toy 10 in steering, an antenna 128, and a button 130 for releasing the hooks from their engagement, permitting the structure 15 to pop out of the load-carrying box of the vehicle toy 10 and launching the projectiles 50 selectively.

Fig. 19 is a block diagram of the main circuit components of the portable remote-control unit 120. The unit 120 is preferably provided with a pair of contacts 124a and 124b, which are closed when the first toggle-control lever 124 is operated to move back and forth, a pair of contacts 126a and 126b, which are closed when the second toggle-control lever 126 is operated to move right and left, and a pair of contacts 130a closed when the button 130 is depressed. Each pair of the contacts 124a, 124b, 126a, 126b and 130a is connected to a mixer circuit 136 by corresponding channel input terminals of a control-signal generator circuit 132. The circuit 192 is controlled by a crystal oscillator circuit 134 which issues an output-control signal and like signals. The mixer circuit 136 preferably issues a control signal to a high-frequency amplifier circuit 138 which in turn issues a remote-control signal to the vehicle toy 10 through the antenna 128.

Preferably, the vehicle toy 10 comprises an antenna 140 (shown in Fig. 20) for receiving a radio-control signal. More specifically, the antenna 140 receives a radio-control signal issued from the remote-control unit 120 and transmits the signal to the receiver circuit 34. In response to the remote-control signal issued from the unit 120, the battery power source is selectively connected with the motor 28 of the drive unit, the steering actuator 18 and the drive motor 20. A typical radio-receiver unit 26 is substantially constructed of a receiver circuit 142, amplifier circuit 146, and a control-signal separator circuit 148. The circuit 148 may be an analog-type, a binary-type or a digital-type circuit through which the received radio-control signal is processed through dividing, mixing, demultiplexing and decoding operations. A first signal, which is generated when the contacts 124a, 124b, 126a, 126b and 130a are connected with the control-signal generator circuit 132, is identified by properly selecting a control system, so that the steering actuator 18, the drive motor 20 or the motor 28 are selectively driven in a desired selected direction.

The above-mentioned receiver circuit and signal processing circuit are well known in the art, and, therefore properly selected in use. The signal separator circuit 148 is preferably provided with at least three independent output channels for controlling the drive circuits of the channels. An electrical traveling drive circuit 150 is connected with the drive motor 20. An electrical-steering circuit 154 is connected with the steering actuator 18. On the other hand, a hook-releasing / projectile-launching circuit 158 is connected with the electric motor 28. In response to the remote-control signal issued from the remote-control unit 120, each of the electric-drive circuits 150, 154 and 158 effectively and selectively connects the vehicle-toy power battery 24 to the motor 20, motor 28, or the actuator 18 so as to effectively and selectively connect with the electric motor or the actuator, which motor or the actuator is connected with a drive circuit having a power battery or having other power sources of the vehicle toy 10. Each of the drive circuits is independently operated as to other electric drive circuits.

Now, the vehicle toy mounting the projectile-launching mechanism of the present invention will be described in operation with reference to Figs. 10 to 17.

In a condition in which the structure 15 is in the first position shown in Figs. 2 and 3, i.e., completely housed in the load-carrying box of the rear portion of the vehicle body 12, the movable hook 39 engages with the stationary hooks 19. In this condition, the movable hook 38 is resiliently urged forward by the coil spring 46. However, since the movable hook 38 engages with the stationary hooks 19 and can not move forward, the rib gear 34 (shown in Fig. 11) is held in its rear position while meshed with the first intermediate gear 33. Consequently, the pin 34c of the rib gear 34 is not engaged with the cam rib 36b of the cam ring 36. As a result, the cam ring 36 does not rotate even when the rib gear 34 rotates. In this condition, when the receiver 26 receives a first radio signal, an electric current for energizing the motor 28 is supplied from the battery 24 to the motor 28 so that the motor 28 rotates to produce torque which is transmitted to the rib gear 34 through the pinion 30, first intermediate gear 32 and the second intermediate gear 33 to rotate the rib gear 34 counterclockwise in the direction of arrow "A" as viewed in Fig. 10. As a result, the first rib 34a, which is formed in the rear surface of the rib gear 34, engages with the hook boss 38a of the movable hook 38 to have the hook 38 slidably move to the right in the direction of arrow B against a resilient force exerted by the coil spring 46 (incidentally, in a condition shown in Fig. 10, the first rib 34a of the rib gear 34 is going to engage with the hook boss 38a of the movable hook 38). Under such circumstances, when the movable hook 38 moves right by a predetermined distance, the movable-pawl portions 38b

of the movable hook 38 disengage from the stationary-pawl portions 19a of the stationary hooks 19 to permit the structure 15 to swingably move upward under the influence of the resilient force exerted by the compression coil spring 42. As a result, the structure 15 assumes its second position shown in Figs. 1 and 4 in which the projectile-launching platform 48 comes in sight so that the projectile 50 is ready for launching.

At this time, when the rib gear 34 further rotates, as shown in Fig. 12, the second rib 34b of the rib gear 34 abuts on the hook boss 38a of the movable hook 38 to stop the rib gear 34 in rotation. Under such circumstances, when the signal disappears, the motor 28 does not produce torque since the radio receiver 26 stops electric-current supply to the motor 28, so that the movable hook 38 is pulled to the left under the influence of the resilient force exerted by the coil spring 46 to have its hook boss 38a abut on the second rib 34b of the rib gear 34, whereby the rib gear 34 rotates counterclockwise to have the first rib 34a and the second rib 34b thereof disposed in positions shown in Fig. 14. On the other hand, when the movable hook 38 disengages from the stationary hooks 19, the movable hook 38 slidably moves forward together with the rib gear 34 as shown in Fig. 13 under the influence of a forward urging force of spring 44 and rib gear 34 has its pin 34c engage with the cam rib 36a of the cam ring 36 while meshing with the second intermediate gear 33. On the other hand, when the structure 15 is popped out of the vehicle body 12 to assume its second position shown in Figs. 1 and 4, the movable hook 38 can be slidably moved widthwise regardless of the stationary hooks 19 of the vehicle body 12.

Now the launching operation of the projectile 50 will be described. In order to launch the projectile 50, it is necessary that the structure pops out of the vehicle body 12 to assume its second position and the projectile 50 is previously loaded. In loading operations of the projectile 50, the round-head portion 50a of the projectile 50 is held by the user's hand so that the tail portion 50b of the projectile 50 is inserted into the projectile-launching sleeve portion 48c of the projectile-launching platform 48 through its opening 48a. Then, the round-head portion 50a of the projectile 50 is rotated to have the projections 50c of the tail portion 50b engage with the guide portion 48e of the platform 48. When the projections 50c at the rear end of the tail portion 50b abut on the launching spring 44, the projectile 50 is further inserted into the sleeve portion 48c of the platform 48 against a resilient force exerted by the launching spring 44 to have the front-end portion of each of the stopper blades 401 - 405 inserted into the engaging groove 50d of the projectile 50 so that the loading operations of the projectiles are completed. The projectile-launching platform 48 is preferably fully loaded with the projectiles 50. After completion of the loading operations of the projectiles into the platform 48, when the structure 15 is depressed against the resilient force exerted by the compression coil spring 42, the structure 15 assumes its first position which is already described with reference to Fig. 10 in the above.

In a condition in which the rib gear 34 and the movable hook 38 are in positions shown in Figs. 14 and 15 and the structure 15 is inclined as shown in Fig. 1. When the radio receiver unit 26 energizes the motor 28 upon receipt of a second signal, the rib gear 34 is rotated counterclockwise through the pinion 30, first intermediate gear 32 and the second intermediate gear 33. Since the second rib 34b of the rib gear 34 may pass under the hook boss 38a of the movable hook 38 when the movable hook 38 is in a position shown in Fig. 14, it is possible for the rib gear 34 to keep on rotating counterclockwise in the direction of arrow "C" shown in Fig. 15. After that, as shown in Figs. 16 and 17, the pin 34c of the rib gear 34 engages with the cam rib 36a of the cam ring 36 so that the cam ring 36 is rotated clockwise in the direction of arrow "D" by a predetermined amount or angle corresponding to one of the ten projections of the cam rib 36a. At this time, the inner cam 36b of the cam ring 36 in a position shown in Fig. 15 moves to its uppermost position shown in Fig. 16 to depress the stopper boss 403a in the direction of arrow "E" radially inwardly as to a center of the cam ring 36. As a result, the front end of the stopper blade 403 moves downward in the through-hole 48f of the spring-housing portion 48d to disengage from the engaging groove 50d of the projectile 50 so that the projectile 50 is launched under the influence of the resilient force exerted by the launching spring 44. In this launching operation, since the helical projections 50c in the tail portion 50b of the projectile 50 loosely and threadably engage with the guide grooves 48e of the spring-housing portion 48d, the projections 50c of the projectile 50 are rotated on a longitudinal axis of the projectile 50 by the guide grooves 48e when the projections 50c of the projectile 50 pass through the guide grooves 48e, so that a so-called gyroscopic effect is produced in the projectile 50 so as to stabilize the projectile 50 in flight attitude, which enables the projectile 50 to keep its round-head portion 50a forward. Since the round-head portion 50a of the projectile 50 is covered with the cushion member, it is possible to protect a person from injuries even when the projectile 50 hits against the person.

When the rib gear 34 is further rotated, the pin 34c of the rib gear 34 disengages from the cam rib 36a of the cam ring 36 so that the cam ring 36 stops in a position in which the inner cam 36b thereof passes the boss 403b of the stopper 40. Then, the rib gear 34 is further rotated to have its first rib 34a abut on the hook boss 38a of the movable hook 38 so that the movable hook 38 is moved to the right to assume the same position as that shown in Fig. 12 in which the second rib 34b of the rib gear 34 abuts on the hook boss 38a to stop the rib gear 34 in rotation. When the second signal disappears, the motor 28 does not produce any torque so that the movable hook 38 is pulled back to the left to return to its position shown in Fig. 14, which permits the rib gear 34 to rotate. Under such circumstances, when a third signal is transmitted to the vehicle toy 10, the same operation as that

performed upon receipt of the second signal is performed, and then the stopper blade 404 is depressed so that the following projectile 50 having been loaded is launched. In the same manner as that described above, the subsequent projectiles 50 are launched one by one each time a signal is received. Consequently, there is no fear that a plurality of the projectiles 50 are continuously launched upon receipt of the same signal lasting long.

In the above embodiment of the present invention, the structure 15 is so described as to be moved from the first position to the second position by the hook mechanism under the influence of the resilient force exerted by the compression coil spring 42. However, it is also possible to employ another embodiment in which the structure 15 moves in a different way. For example, the structure 15 may perform any motion, for example, may expand, swing, extend, spread, open, move back and forth, move widthwise, rotate or otherwise elevate. Further, it is also possible for the structure 15 to be operated by a reversible-type actuator.

In the embodiment of the present invention, the number of the loaded projectiles 50 is five, as shown in the drawings. However, it is easy and obvious for those skilled in the art to modify the embodiment of the present invention in mechanism so as to load the number more (or less) than five of the projectiles 50 in the vehicle toy 10.

As for the control unit of the present invention, although the embodiment of the present invention is described so as to be controlled by wireless, it is also possible to control the embodiment of the vehicle toy 10 by wire. In other words, it is also possible to supply a control signal from the remote-control unit to the vehicle toy 10 through wires, or, it is also possible to directly transmit the electric drive signal from the remote-control unit to the drive circuit mounted on the vehicle toy 10.

Although the embodiment of the present invention is radio-controlled, it is also possible to control the embodiment of the present invention by using other wireless systems, for example such as infrared-signal systems and ultrasonic-signal systems. After a control signal is directly received by in a signal receiver or after the thus received signal is amplified in an amplifier for controlling relays and other switches used in order to supply more current to motors and actuators, or, according to a control signal issued from an on-board processor (not shown) of the vehicle toy, a necessary power may be supplied to an electrically-driven actuator of the vehicle toy.

Although the preferred embodiments of the present invention have been described in the above to disclose and suggest many improvements, it is clear for those skilled in the art to appropriately modify the embodiments in application. Therefore, it is intended that all matters given in the above description and illustrated in the accompanying drawings shall be interpreted to be illustrative only, and not as a limitation to the scope of the present invention.

As described in the above, the vehicle toy 10 mounting the projectile-launching mechanism of the present invention shows much originality in operation without using a complex circuit is improved in flight range by using a simple and low-cost mechanism, permits a user to safely play with it, and comprises: the structure 15 mounted on the toy 10 and capable of moving from the first position to the second position so as to form in outline a part of the vehicle body 12 of the toy 10 in the first position and pop out of the vehicle body 12 in the second position; the popping-out mechanism by which the structure 15 is moved from the first position to the second position so as to pop out of the vehicle body 12; the projectile-launching platform 48 having the projectile-launching mechanism which is provided in the structure 15 so as to be housed in the vehicle body 12 in the first position and appear in sight in its launching position when the structure 15 is in the second position; and, the launching control means for controlling the projectile-launching mechanism.

Hook 38c may be made of resilient material, resiliently mounted to movable hook 38 or both.

Claims

1. A remotely-controlled vehicle toy mounting a projectile-launching mechanism comprising:

   a structure which is mounted on a vehicle body of said vehicle toy and capable of moving from a first position to a second position so as to form in outline a part of said vehicle body in said first position and pop out of said vehicle body in said second position;

   a popping-out mechanism through which said structure is moved from said first position to said second position so as to pop out of said vehicle body;

   a projectile-launching platform provided with a projectile-launching mechanism which is provided in said structure so as to be housed in said vehicle body in said first position and appear in sight in its projectile-launching position when said structure is in said second position; and

   a projectile-launching control means for controlling said projectile-launching mechanism.

2. The vehicle toy mounting said projectile-launching mechanism as set forth in claim 1, wherein:

   said structure having one of its opposite end portions pivotally attached to a portion of said vehicle body and the other of said opposite end portions formed into a free-end portion on which said projectile-launching platform provided with said projectile-launching mechanism is mounted.

3. The vehicle toy mounting said projectile-launching mechanism as set forth in claim 1 or 2, wherein:

   said projectile-launching platform is provided with at least one projectile-launching sleeve;

said projectile-launching mechanism is provided with a projectile-energizing means for giving a flight force to a projectile, a restricting means for temporarily restricting the launching of said projectile and a release means for releasing said projectile from restrictions placed upon the launching of said projectile; and

said projectile-launching control means is provided with a release mechanism which drives said release means so as to release said projectile from said restrictions upon receipt of a radio signal.

4. The vehicle toy mounting said projectile-launching mechanism as set forth in claim 3, wherein:

said projectile-launching platform is provided with a guide portion in its projectile-loading portion, said guide portion being provided with at least two slits; and

said projectile is constructed of a head and a tail cylindrical portion, said tail cylindrical portion being provided with an engaging groove while said head cylindrical portion is covered with a cushion member, said tail cylindrical portion being further provided with at least one helical projection in its outer peripheral portion, said helical projection being small in helix angle and loosely and threadably connected with said slits of said guide portion of said projectile-launching platform.

5. The vehicle toy mounting said projectile-launching mechanism as set forth in any one of claims 1, 2 and 3, wherein said popping-out mechanism is provided with:

a structure-energizing means for giving a popping-out force to said structure so as to move said structure from said first position to said second position;

a movable hook on which a resilient force is applied to urge said movable hook toward its engaging direction so as to have said movable hook engage in said first position with a stationary hook provided in a portion of said vehicle body and disengage from said stationary hook in said second position; and

a rib gear driven by a motor and provided with a knock rib which is rotatably driven to kick a hook boss of said movable hook so as to slidably move said movable hook from its engaging position to its disengaging position.

6. The vehicle toy mounting said projectile-launching mechanism as set forth in any one of claims 1 to 5 wherein said projectile-launching mechanism is provided with:

a launching spring for launching said projectile;

said projectile-launching platform which is provided with at least one through-hole for holding said projectile thereto;

a cam ring provided with a rotatably-driven protruding cam; and

a projectile stopper which is provided with: a stopper boss abutting on said protruding cam; an engaging-end portion inserted into said engaging groove of said projectile so as to prevent said projectile from launching, said projectile stopper being driven by said protruding cam;

whereby said protruding cam of said cam ring intermittently rotated abuts on said stopper boss so as to slidably move said projectile stopper in its disengaging direction.

7. The vehicle toy mounting said projectile-launching mechanism as set forth in claim 6, wherein:

said projectile-launching mechanism is provided with at least a pair of projectile-launching sleeves and at least a pair of said projectile stoppers;

a stopper rib provided in said rib gear is free from a hook boss of said movable hook in said engaging position where said movable hook engages with said stationary hook, which permits said rib gear to rotate;

when said rib gear rotates to have said knock rib abut on said hook boss of said movable hook, said movable hook is moved to said disengaging position thereof against said resilient force applied to said movable hook;

in a downstream side of said knock rib in its rotating direction, said stopper rib is so provided that said stopper rib engages with said hook boss of said movable hook in said disengaging position to stop said rib gear in rotation;

said movable hook returns to said engaging position thereof under the influence of said resilient force when said motor stops in rotation to transmit no torque to said rib gear;

when said rib gear is rotatably driven again, the operations described above are repeated so that said projectile stoppers are driven each time said rib gear is rotated 360 degrees, whereby said projectile are launched one after the other.

8. The vehicle toy mounting said projectile-launching mechanism as set forth in any one of claims 1 to 7 wherein:

said vehicle toy is provided with a radio transmitter and a radio receiver so as to be radio-controlled in forward and rearward traveling operations, in steering operations and moving operations of said structure, and in launching operations of said projectiles.

FIG. 1

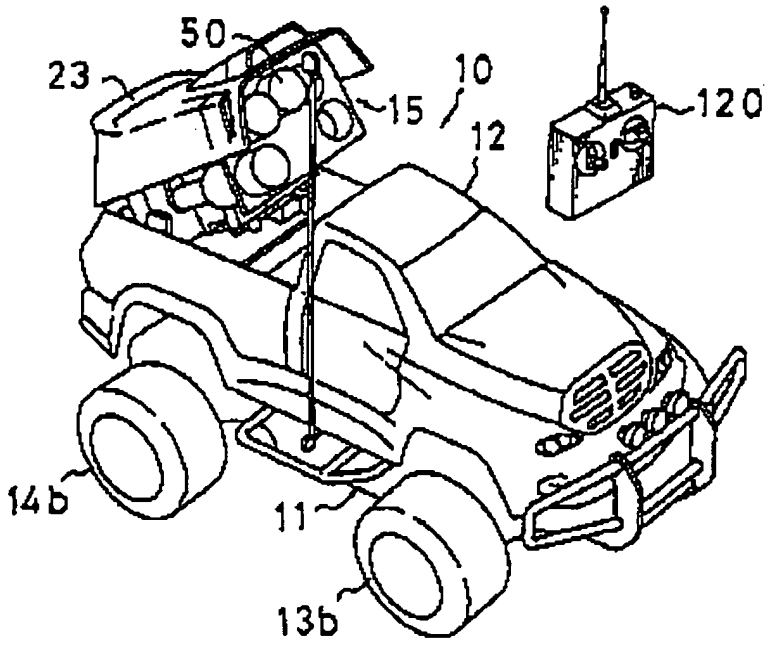
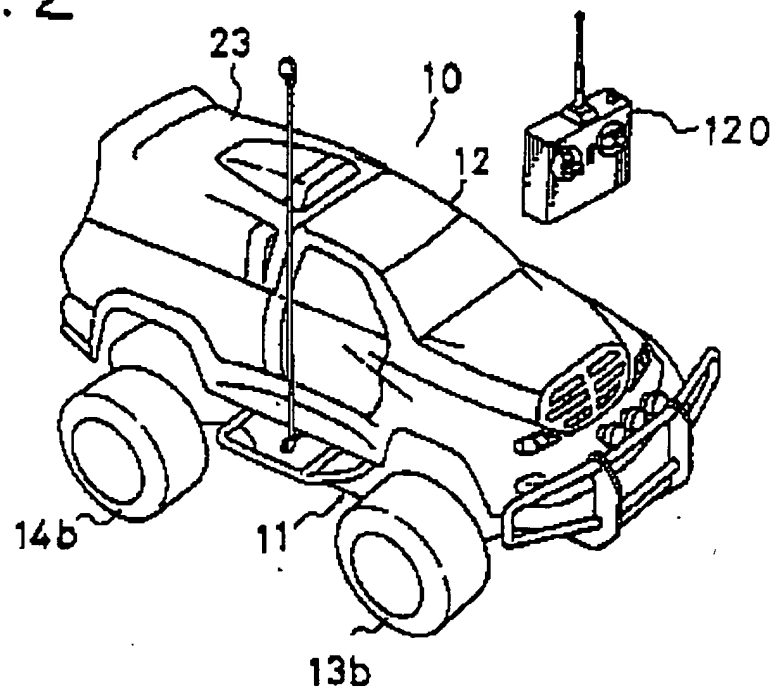
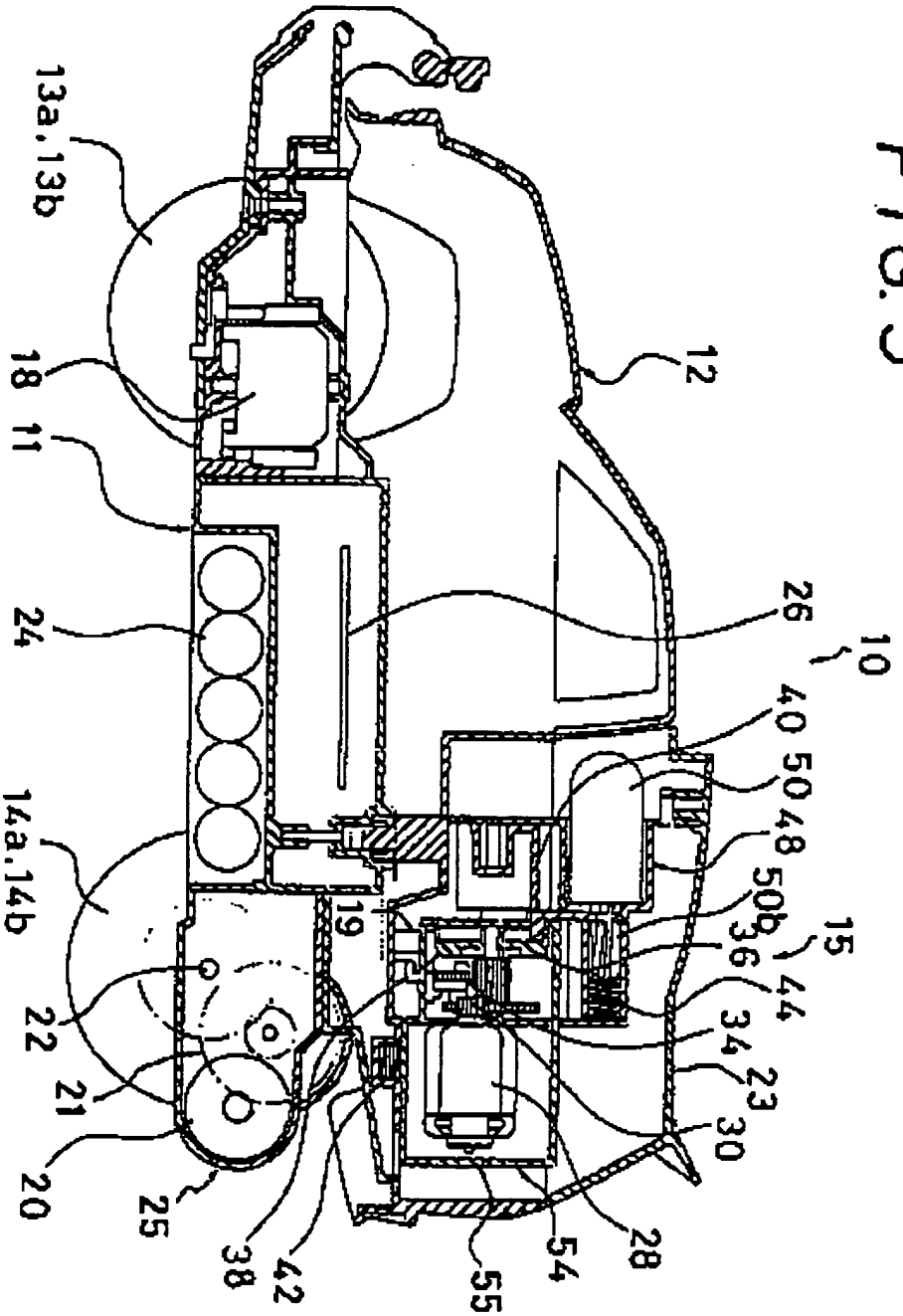


FIG. 2

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11
12
24
26
10
40
50
48
50b
36
15
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14a,14b
19
22
21
20
25
38
42
55
54
28

FIG. 3

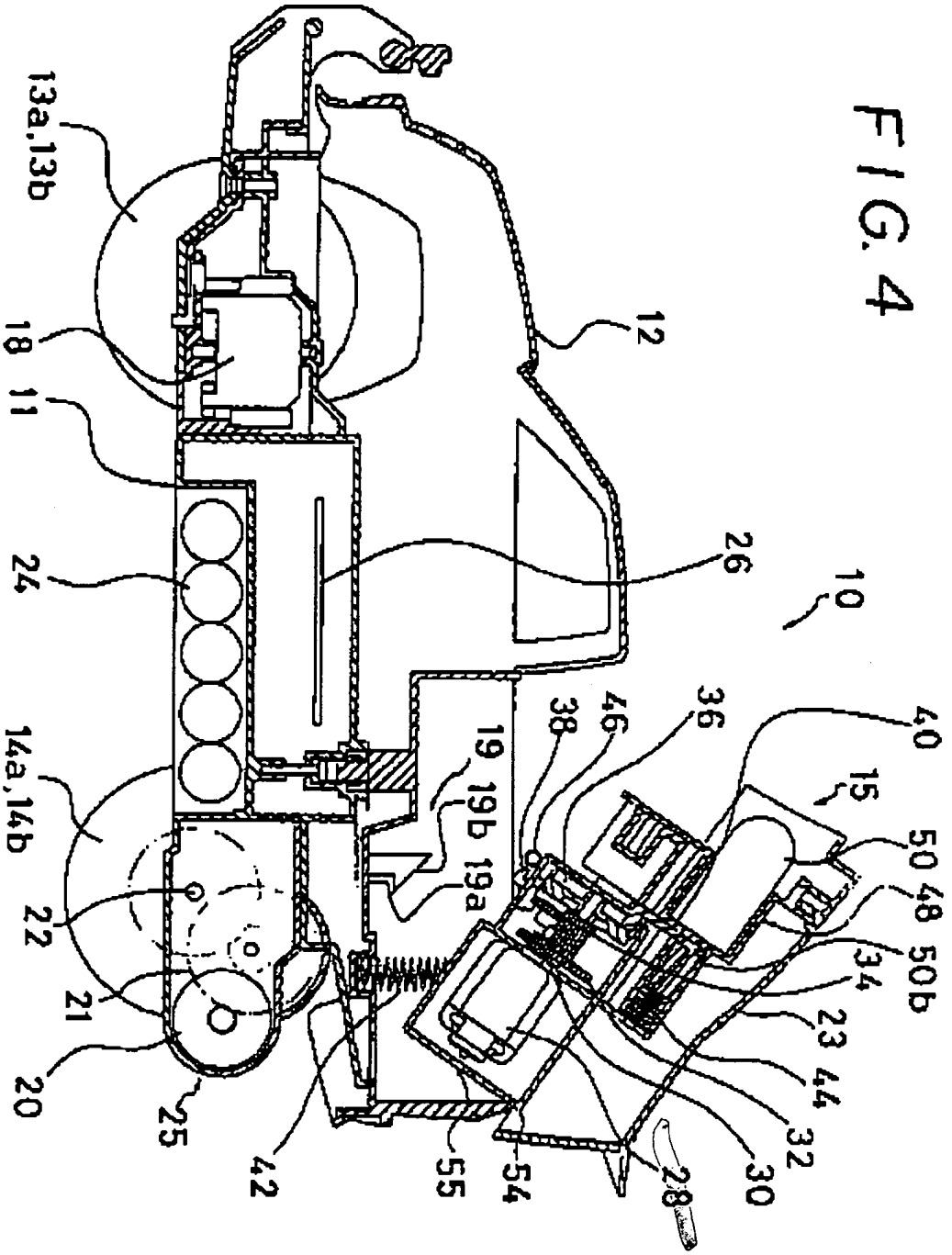

13a,13b
18
11
12
24
26
10
40
36
38
46
19
19b
19a
15
50
48
50b
14a,14b
22
21
20
25
42
55
54
28
30
32
44
23
34

FIG. 4

FIG. 5

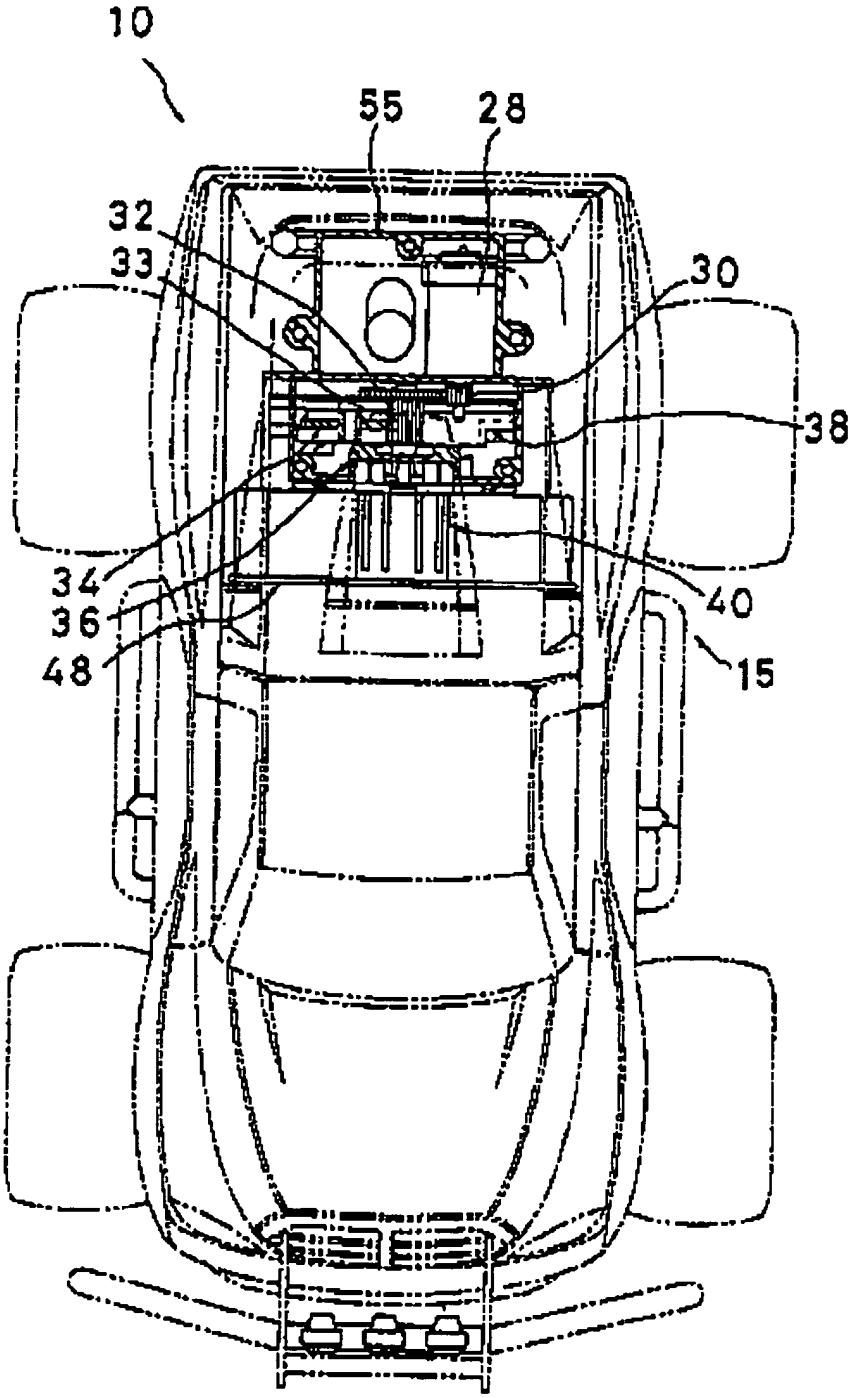


FIG. 6

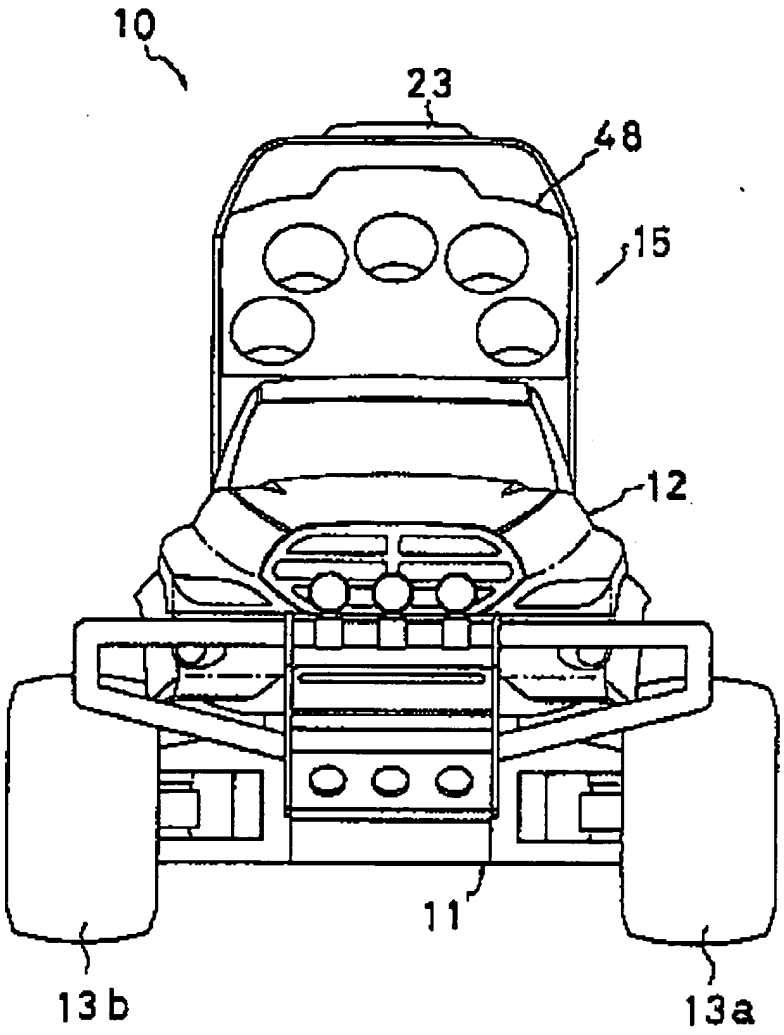
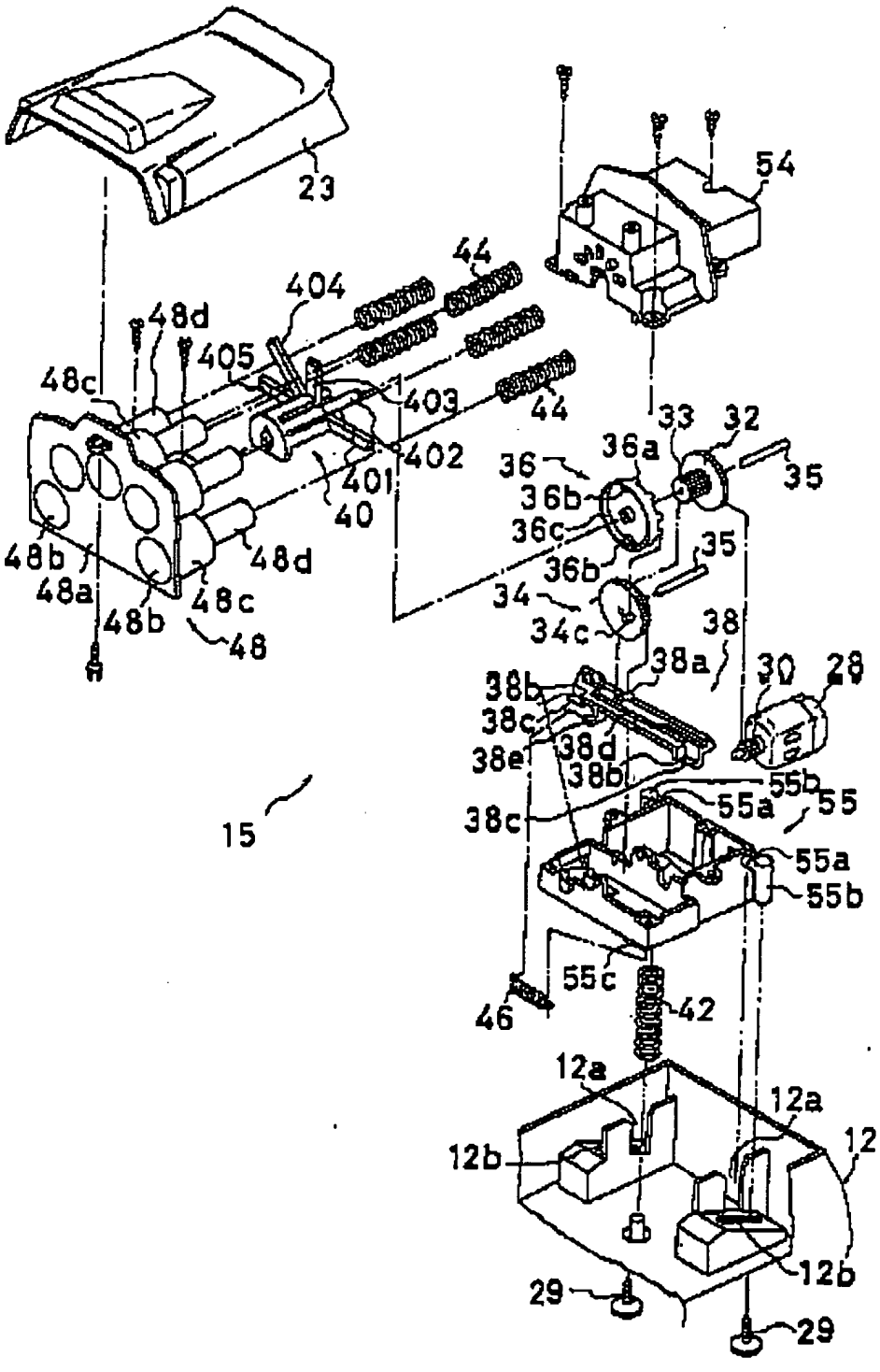


FIG. 7


23
54
44
404
48d
405
48c
403
44
33
32
36a
36
35
36b
36c
402
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48b
48a
48d
48c
48b
48
34
34c
38
38a
30
28
38b
38c
38e
38d
38b
55b
55a
55
38c
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55b
55c
46
42
15
12a
12a
12
12b
12b
29
29

FIG. 8

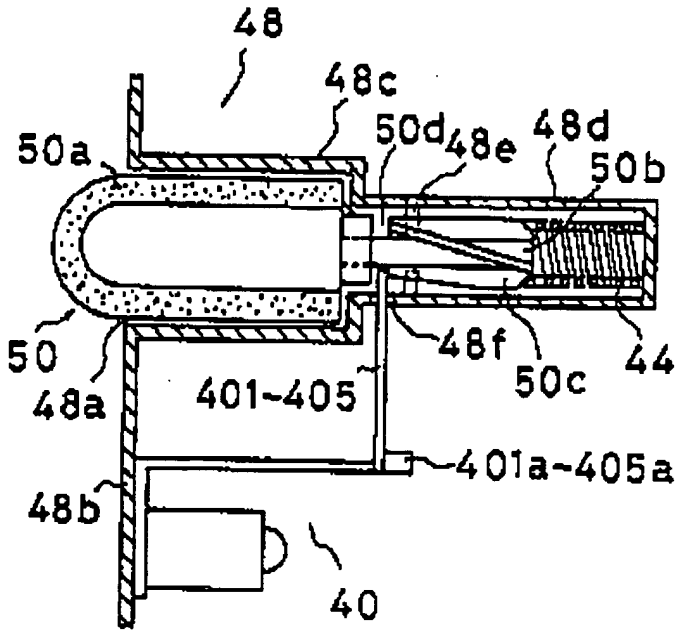

48
48c
50d
48e
48d
50a
50b
50
48a
401~405
48f
50c
44
401a~405a
48b
40

FIG. 9

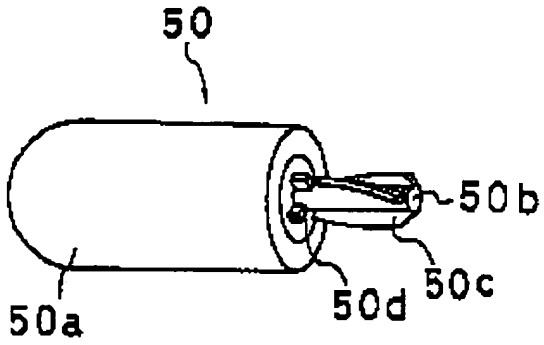
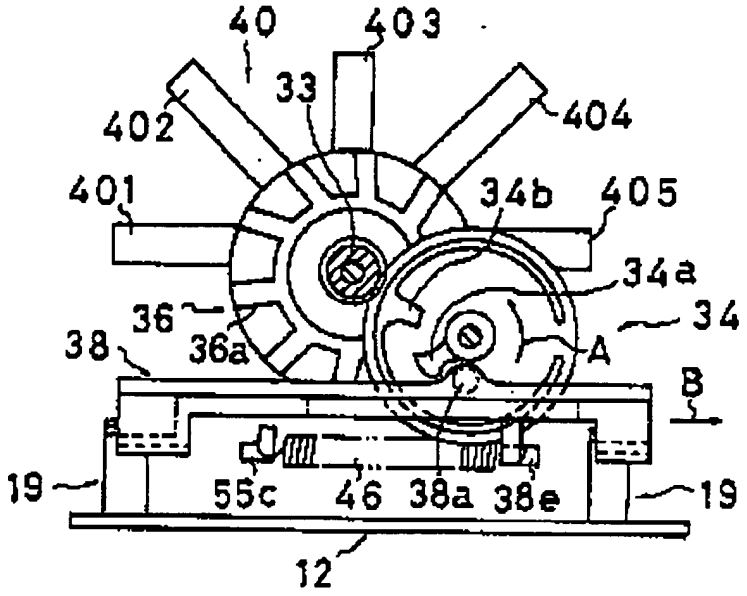

50
50b
50c
50d
50a

FIG. 10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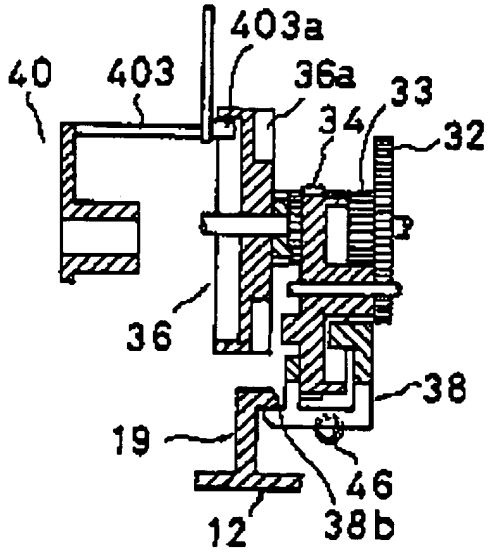
403
33
402
404
401
34b
405
34a
36
36a
34
38
A
B
19
55c
46
38a
38e
19
12

FIG. 11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40
403
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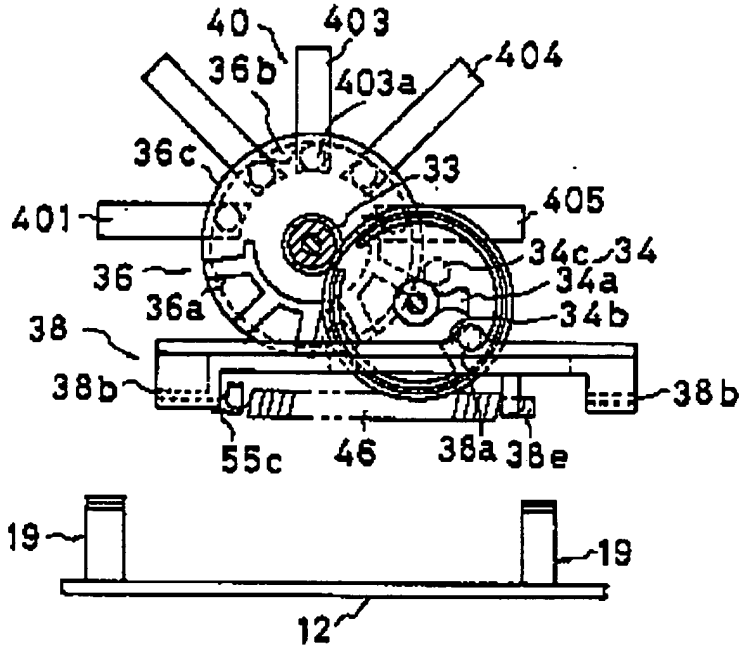
33
34
32
36
38
19
46
12
38b

FIG. 12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403
36b
403a
404
36c
33
401
405
34c
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34b
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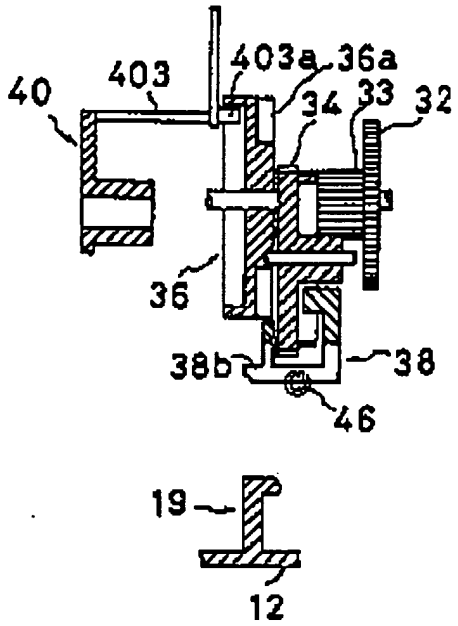
38b
55c
46
38a
38e
19
19
12

FIG. 13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403
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36a
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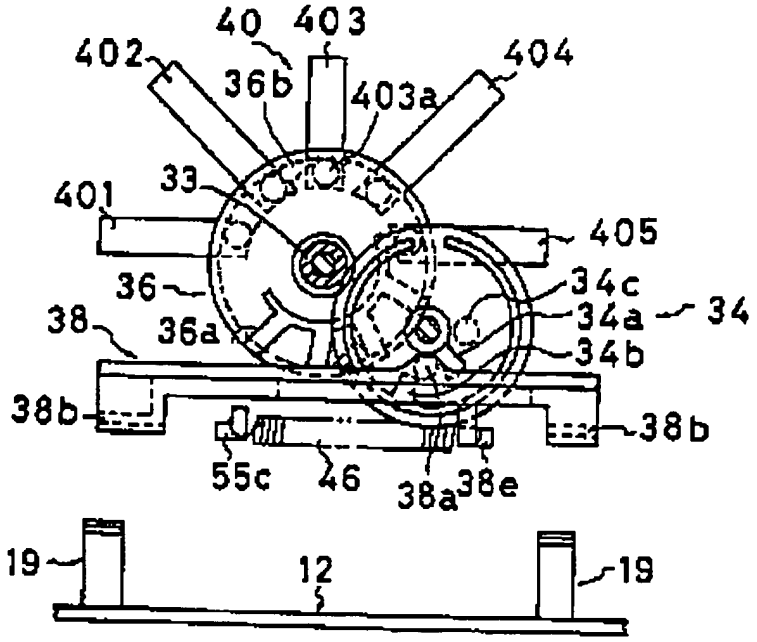
33
32
36
38b
38
46
19
12

FIG. 14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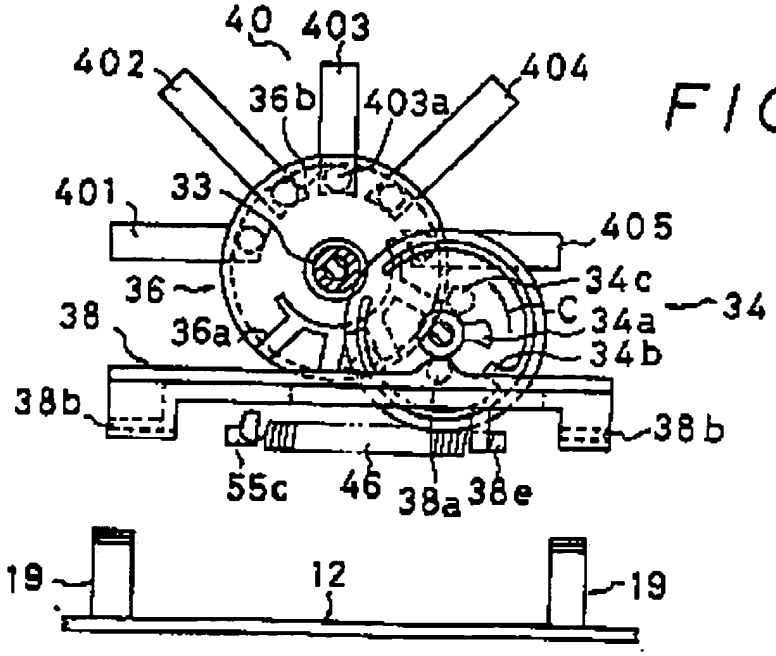
403
402
404
36b
403a
33
401
405
36
34c
34
38
36a
34a
34b
38b
38b
55c
46
38a
38e
19
12
19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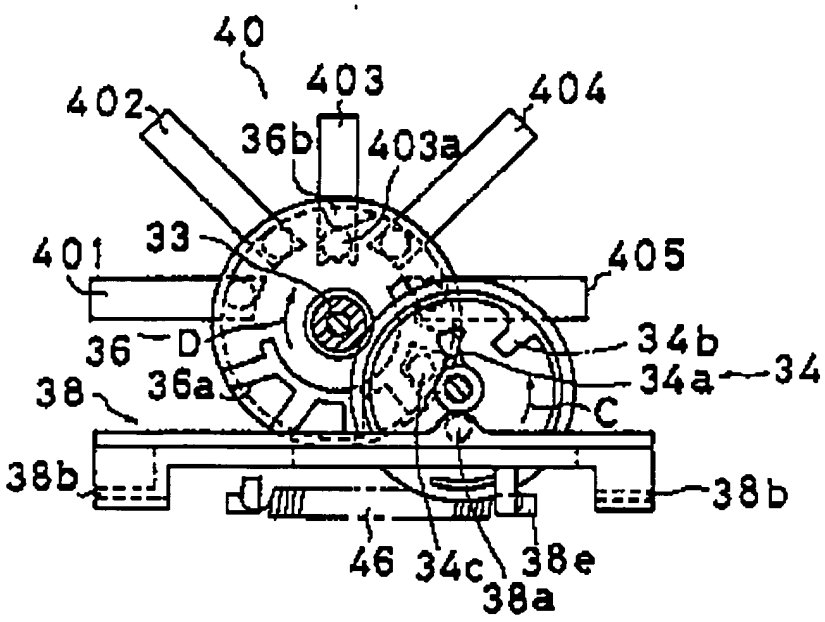
403
402
404
36b
403a
33
401
405
36
34c
34
38
36a
C
34a
34b
38b
38b
55c
46
38a
38e
19
12
19

FIG. 15

FIG. 16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403
402
404
36b
403a
33
401
405
36
D
34b
34a
34
38
36a
C
38b
38b
46
34c
38e
38a

FIG. 17

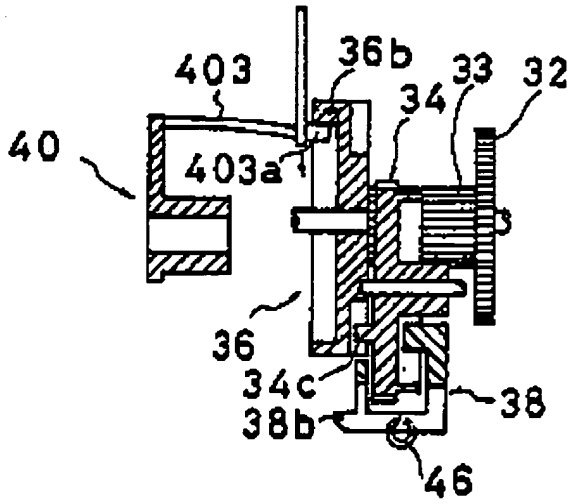

403
36b
33
32
34
40
403a
36
34c
38
38b
46

FIG. 18

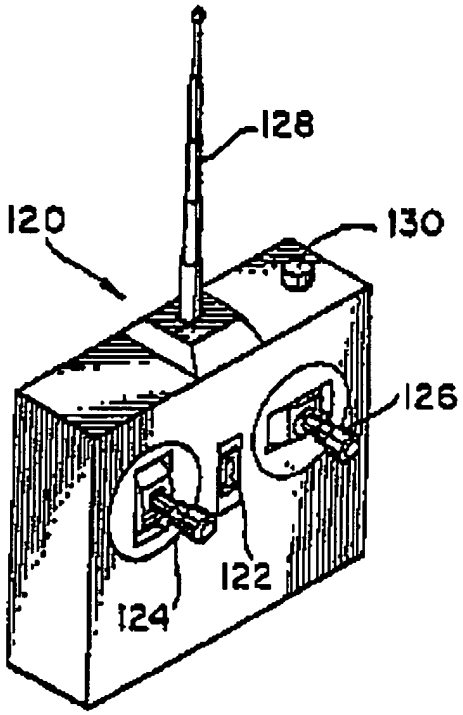


FIG.19

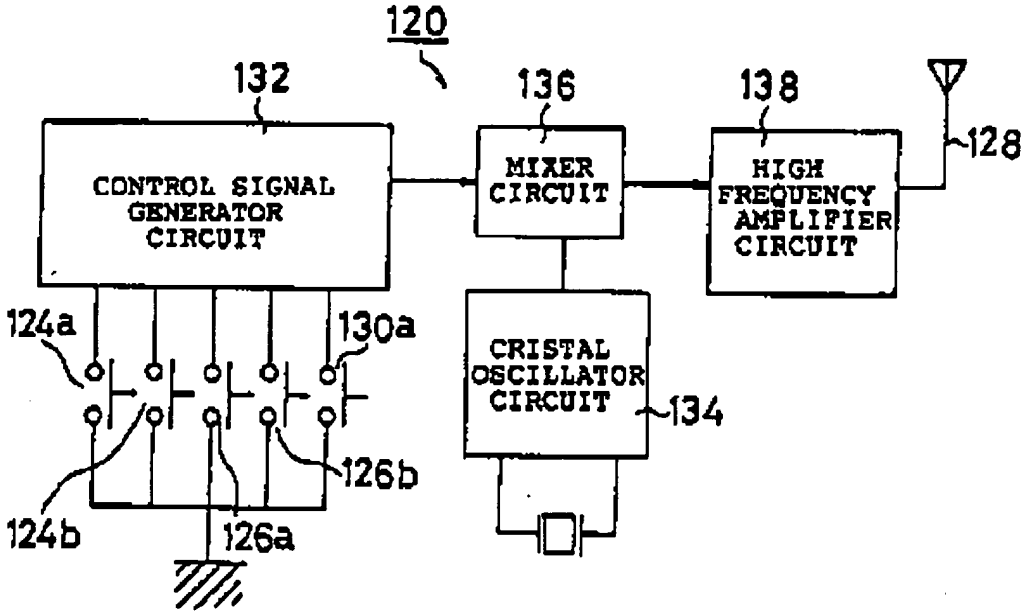
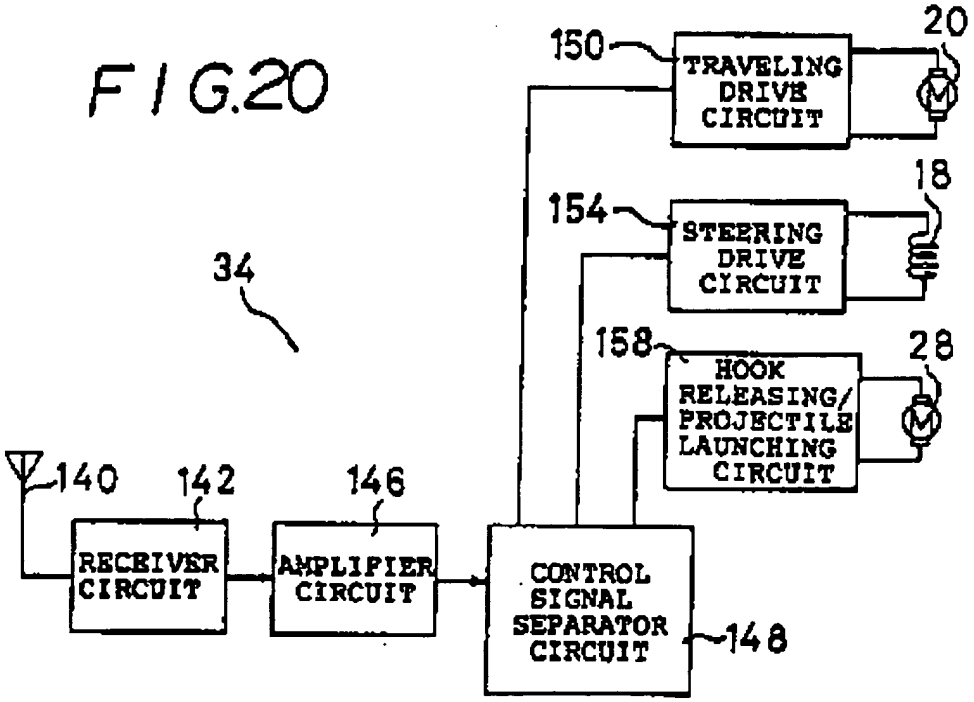

120
132
136
138
128
CONTROL SIGNAL GENERATOR CIRCUIT
MIXER CIRCUIT
HIGH FREQUENCY AMPLIFIER CIRCUIT
124a
130a
CRISTAL OSCILLATOR CIRCUIT
134
126b
124b
126a

FIG.20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TRAVELING DRIVE CIRCUIT
20
154
STEERING DRIVE CIRCUIT
18
34
158
HOOK RELEASING/ PROJECTILE LAUNCHING CIRCUIT
28
140
142
146
RECEIVER CIRCUIT
AMPLIFIER CIRCUIT
CONTROL SIGNAL SEPARATOR CIRCUIT
148